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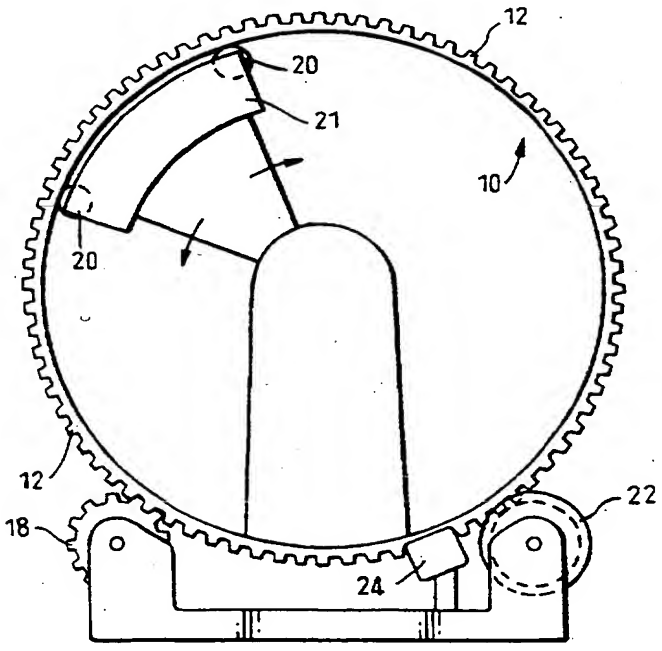
(54) Abstract Title
Spinning reel mechanism

(57) A spinning reel mechanism has a reel 10, a plurality of teeth 12 arranged circumferentially around the reel, a motor 16 driveably engageable with the teeth to rotate the reel, and a sensor 24 which monitors the passing of the teeth as the reel is rotated. The sensor may be a reflective optical sensor arranged to count pulsed reflections off the teeth. Alternatively, the sensor could detect magnetic printing ink applied to the teeth.

Fig.1.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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Claims searched: All

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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): G4V

Int Cl (Ed.7): G01P; G07F 17/34

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2073467 A	(AINSWORTH)	
X	US 4528471	(BAUMANN) example of a rotating body with teeth and a position sensor	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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CLAIMS

1. A spinning reel mechanism comprising a reel, a plurality of teeth arranged circumferentially of the reel, a motor drivably engageable with the teeth in order to rotate the reel, and a sensor which monitors the passing of the teeth as the reel is rotated.

2. A spinning reel mechanism according to claim 1, in which the teeth are formed integrally with the reel.

3. A spinning reel mechanism according to claim 1 or claim 2, in which the teeth are formed around the outer peripheral surface of the reel.

4. A spinning reel mechanism according to any preceding claim, in which the motor is a d.c. motor.

5. A spinning reel mechanism according to any one of claims 1 to 4, in which the sensor is a reflective optical sensor arranged to count pulsed reflections off the teeth.

6. A spinning reel mechanism according to any one of claims 1 to 4, in which the sensor senses the gaps between the teeth by monitoring non-reflected radiation.

7. A spinning reel mechanism according to any one of claims 1 to 4, in which the sensor senses magnetic printing ink applied to the teeth.

8. A spinning reel mechanism substantially as hereinbefore described with reference to the accompanying drawings.

error. The position error is then automatically corrected via the PID loop.

It will be appreciated that PID (Proportional Integral Derivative) control is known per se.

A spinning reel mechanism, in accordance with the present invention, will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a schematic front view of the spinning reel mechanism; and

Figure 2 is an end view of the spinning reel mechanism.

In the accompanying drawings, a reel 10 is provided around its entire outer periphery with a plurality of circumferentially arranged teeth 12.

The teeth 12 may be integrally moulded on one of a pair of opposed annular flanged edges 14 of a plastics skeletal drum with the flanged edges 14 locating therebetween a plastics translucent strip 15 carrying symbols (not shown).

The teeth 12 may be driven directly by a d.c. motor (not shown) or indirectly by a d.c. motor 16 via a drive gear 18 and/or other optional gearing (not shown).

The reel 10 may be supported internally by support rollers 20, on an adjustable lamp array 21, and externally by three idler gears 22.

In use, a sensor 24 in the form of a reflective optical sensor is arranged to monitor the passing of the teeth 12 as the reel 10 is rotated, this being achieved by counting the reflections from the teeth 12 as the teeth 12 sequentially pass the reflective optical sensor, thereby enabling the rotary position of the reel 10 to be calculated in a known manner.

converted back to voltage and then fed into an ADC, this will provide an encoded input for the motor controller. The resolution through one revolution of the reel is determined from the resolution of the ADC.

The GMR does not have to physically contact the magnet so there is no wear and tear to either the GMR or the magnet. The GMR can sense the absolute position of the reel even if the reel was removed and replaced in another position. This allows the reel to be driven from power-up into a game without any reset procedure. The GMR is affected by external magnetic fields. However, unless the GMR is driven like a disc unit, the direction of field is at 90° to the front glass of the gaming machine. Consequently, magnetic interference outside the gaming machine would have negligible effect, dependent on the size of the magnet used with the GMR and the size of the magnet outside the gaming machine.

The GMR provides an absolute encoder solution for use with PID control which requires high resolution feedback (closed loop).

PID servo control will determine speed, acceleration and position. The PID loop can be developed both in hardware (using op-amps) or software (preferred solution). The PID loop uses negative feedback (position error) to drive the reel.

More particularly, at standstill the motor is not driven. If the reel is moved, the encoder detects the movement and the motor controller will then calculate the error and drive the reel back to where it should be positioned. Therefore, there is no power applied to the motor unless the reel is moved out of position. This in reality causes power to be applied to correct the error, and feels like the reel is "locked" in place.

If a movement is required, the controller determines the speed and acceleration and drives the reel to the required position. The controller subtracts the present position from the required position to get a position

reel, being subsequently secured thereto, and the teeth could be located inwardly of the outer peripheral surface of the reel.

Preferably, the motor is a d.c. motor to reduce costs and achieve fast revolutions of the reel.

Preferably, the sensor is a reflective optical sensor arranged to count pulsed reflections off the teeth, thereby enabling the rotary position of the reel to be established with respect to a fixed datum, but the sensor could sense the gaps between the teeth by monitoring non-reflected radiation or could alternatively sense magnetic printing ink applied to the teeth.

The fixed datum may be established in any known manner.

According to another aspect of the present invention, a spinning reel mechanism comprises a reel, drive means for rotating the reel, and proportional integral derivative (PID) means for controlling the operation of the drive means.

A particular advantage of combining both aspects of the present invention is that the motor can be positioned away from the central axis of the reel, thereby allowing use of Siemens Electronics' PID Servo Control in which a "Giant Magneto Resistor" (GMR) is positioned on the central axis of the reel.

In use, the GMR will feed back the position of the reel dependent on the magnetic polarity and the field direction of a magnet fixed to and rotatable with the reel.

The GMR is not dependent on magnetic field strength, provided that there is a minimum level of magnetic field strength, but relies instead on the change in the direction of the magnetic field. This direction change causes the resistance in a semi-conductor to alter linearly so that as the magnet is rotated through 360° a sine wave is produced from the GMR.

If a voltage is applied to the GMR, a change in current will be noticed on the output. If this current is

Fig.2.

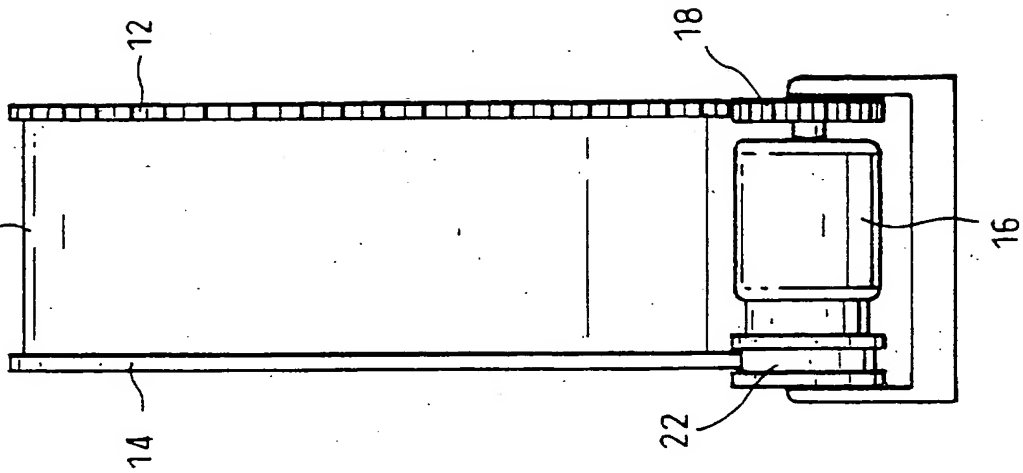
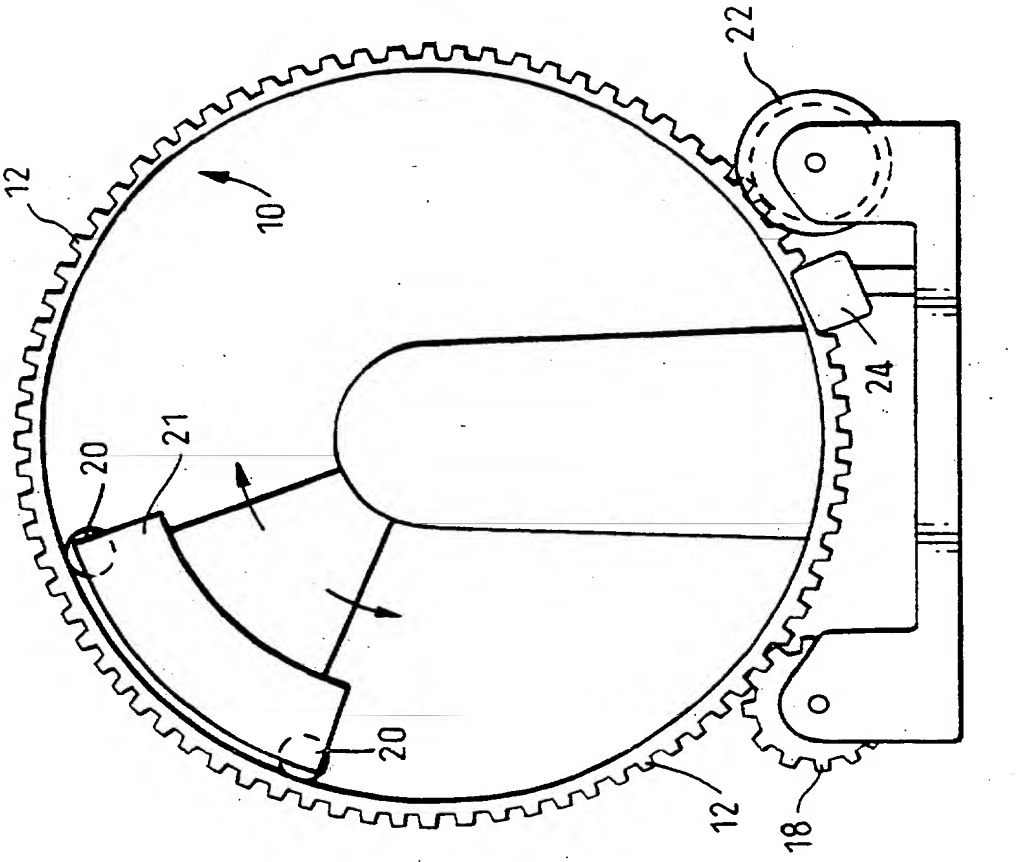


Fig.1.



SPINNING REEL MECHANISMS

The present invention relates generally to spinning reel mechanisms and is especially, but not exclusively, concerned with spinning reel mechanisms for use with gaming machines, sometimes referred to as fruit machines or amusement machines.

Typically, a gaming machine includes a series of adjacent reels, the reels carrying respective reel strips marked around their circumferential surfaces with symbols, such as fruit.

In operation, the reels are caused to spin about a common axis by pulling on a handle, or pressing a button, and when the reels come to a standstill, the positions of the symbols on the reel strips are considered in relation to one or more win lines.

The reels are usually secured to respective rotors of separate stepper motors such that all of the rotors lie on the common axis.

However, it is known from GB-A-2297857, to which an interested reader should refer, for each of the reels to be driven by a stepper motor whose rotor is offset from the common axis and is drivably connected to an internal toothed periphery incorporated in the reel inwardly of the outer periphery thereof.

An object of the present invention is to provide a spinning reel mechanism whose reliability can be readily improved/or readily monitored.

According to one aspect of the present invention, a spinning reel mechanism comprises a reel, a plurality of teeth arranged circumferentially of the reel, a motor drivably engagable with the teeth in order to rotate the reel, and a sensor which monitors the passing of the teeth as the reel is rotated.

Preferably, the teeth are formed integrally with the reel around the outer peripheral surface of the reel - however, the teeth could be formed separately from the